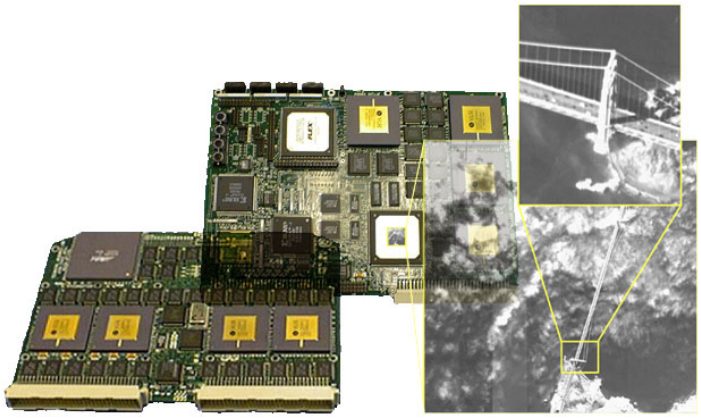


Real-Time Compression Technology

Proven Solutions for Real-Time Image Compression Needs

Dramatically increase image data throughput and utility with real-time compression systems from the Space Dynamics Laboratory of the Utah State University Research Foundation (SDL/USURF). While today's electro-optical sensors can meet the government's needs for tactical/reconnaissance (TAC/RECCE) imagery and real-time recording, current limitations of recorders and communications links restrict the amount of data that can be used from these cameras. Data compression offers a means of significantly reducing the volume of data generated by these sensors, thereby enabling rapid transmission and immediate use. SDL/USURF has been on the cutting edge of image data compression research and development for more than a decade, and has developed a proven system that offers real-time compression/decompression without compromising the information the data contain.

Backed by Extensive R&D

Through a dynamic relationship between the Electrical and Computer Engineering Department of Utah State University and the Space Dynamics Laboratory, SDL/USURF has made substantial progress in image compression research in terms of image quality versus compression ratio. Faculty and students at the university research the latest compression theories and concepts and develop new algorithms. SDL/USURF provides implementation and support, including further algorithm research, design, development, test, field support, contract support, and financial accounting.

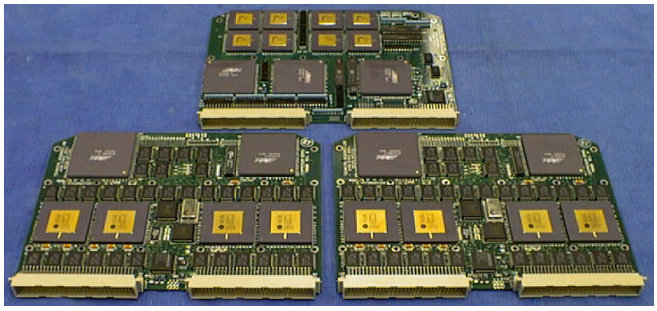
Evidence of USURF's academic progress is indicated by the production of 30 master's degrees and 3 Ph.D. degrees, and the publishing of 34 technical articles in journals such as IEEE, AIAA, SPIE, and the international Data Compression Conference. Fourteen patents have been issued, and 4 more have been filed. Over $12 million has been received in research contracts and grants. In addition, USURF has studied and participated in the development of the JPEG and MPEG 1,2 and 4 standards. USURF is a member of the JPEG 2000 ISO standards committee.

SDL/USURF has experience designing, building, integrating and testing imagery compression systems for various applications, including space-based sensors, reconnaissance cameras and ground stations, commercial video, videophone, and medical imagery. Implementations include mammography, ultrasound, and CTR imagery for Sorenson Development, Inc., Video Phone for Sorenson Vision, Inc., entertainment television for Scientific Atlanta and Omnibox, Polar Imager satellite for NASA, the Midcourse Space Experiment (MSX) for BMDO, and multiservice/multinational airborne reconnaissance for Recon Optical, Inc., NRL, and others. This experience includes the development and fabrication of six very large scale integrated (VLSI) compression chips.

Field-Tested TAC/RECCE Implementation

SDL/USURF's current TAC/RECCE real-time compression system was developed for use with CAI/Recon Optical's CA-260® and CA-261® digital step-framing reconnaissance cameras. The system has been extensively tested as part of the Tactical Airborne Reconnaissance Pod System – Completely Digital (TARPS-CD) demonstrations and exercises.

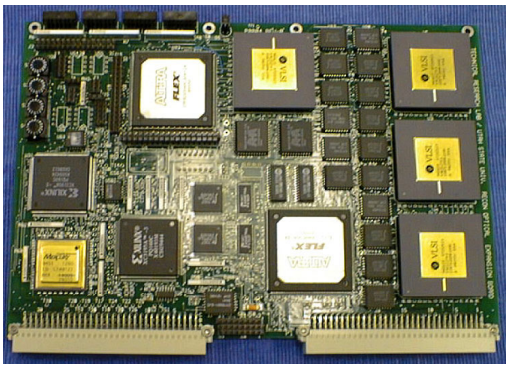
This real-time compression system uses a patented High Quality Vector Quantization (HQVQ) algorithm and can be configured to support framing or linear detectors. For the current configuration, SDL used a 0.6 micron standard cell process to fabricate the compression engine and delivered a three-card compression sub-assembly for integration directly into the camera electronics. The assembly consists of a data controller and two scaleable compressors.



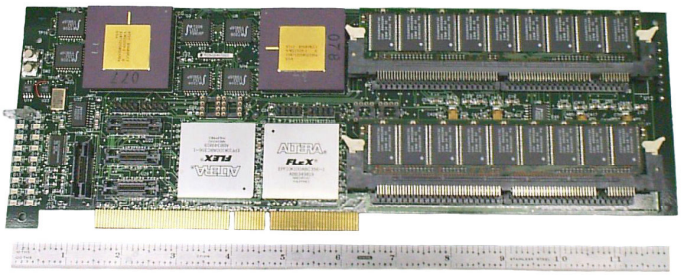
This compression system provides:

- HQVQ implementation, scaleable in throughput and frame size
- Programmable fixed output data rate (match data link requirements)
- 5k×5k, 2.5 frames/sec performance (higher rates possible)
- 65 MBytes/sec compression with ECC for robustness (peak input data rate of 80 Mbyte/sec)
- 2:1 to 20:1 compression range
- Performance optimization at 7:1 for 85M bits/sec and 14:1 for 42M bits/sec operation.

SDL/USURF developed a corresponding two-card expansion set to allow real-time expansion and display of digital imagery. The real-time data decompression board utilizes standard data busses (VME-64 and RACEway) for ease of implementation. This two-card board set supports full real-time, 2.5 frames/sec expansion to display/processing/exploitation memory.



SDL/USURF also designed a PCI interface decompression card for use on portable, Windows NT®-based personal computers (PCs). This system allows for rapid screening of data tapes from a reconnaissance pod.



Future Developments

SDL/USURF's compression technology continues to stay abreast of the latest requirements in TAC/RECCE imagery. To ensure compatibility throughout the services, the National Imagery and Mapping Agency (NIMA) has mandated a constraint on the development of suitable data compression techniques, requiring that any compression techniques developed for TAC/RECCE comply with the National Imagery Transmission Format Standard (NITFS), and use the associated approved algorithms. Under the Advanced Reconnaissance Compression Hardware (ARCH) program, SDL/USURF is developing real-time data compression and decompression boards for TAC/RECCE application in a common, system-configurable hardware set that will meet NITFS certification requirements and implement the NITFS-approved algorithms.

The boards developed under the ARCH program implement algorithms for the NIFTS 2.1 JPEG format. SDL/USURF is designing the compression and decompression hardware to be compatible with many sensor types (e.g., large format framing and scanning sensors), and to be of modular design to accommodate future higher rate single- and multi-band sensors. This hardware will support real-time NITFS/ISO image compression/decompression and will become the state-of-the-art technology used in the next-generation reconnaissance system, the Shared Reconnaissance Pod (SHARP).

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